Description

Gas-Tight Food Package and a Method, Device and Tray for Producing It

The invention relates to a food package in accordance with the preamble of claim 1 as well as a method for producing a like package in accordance with claim 13, a device for carrying out a like method in accordance with the preamble of claim 19, and a suitable semi-finished product or tray having the form of erected and bonded trays in accordance with claim 23, and a method for producing it.

A large variety of food packages is being marketed, with particular efforts being made in recent years to restrict the content of non-recyclable plastics materials in such packages to a minimum. Preference has hitherto been given to food packages in the form of deep-drawn plastic trays generally thermo-formed of a carrier material which is comprised, e.g., of PVC, polystyrene or polyester.

In the conventional trays produced of PVC, polyester or polystyrene, due to conditions of production technology on so-called "vacuum forming and loading plants", there results a very inhomogeneous thickness distribution based on the starting thickness available in the known thermoplastic deformation process.

Hereby on the one hand a high starting thickness of up to 1000 μm is necessitated with respect to the desired molding depth and container shape in order to obtain the required remaining wall thicknesses in the rounded bottom portions. On the other hand, thickness reduction of the plastic films employed for forming the plastic trays in the rounded bottom portions very frequently results in so-called "buckling" which may occur particularly during transport.

It was equally found in serial investigations that the barrier layer employed in producing the plastic trays, preferably of polyvinyl alcohol

(PVA), which ensures the required oxygen barrier and is embedded between carrier film and seal layer in a previously described application of so-called rigid-film compounds, presents a substantially poorer molding result, i.e., low remaining wall thicknesses also of this PVA layer.

It is therefore evidently necessary for the plastics carrier material of the trays to be formed, which is required for dimensional stability, to be equipped with an additional oxygen barrier layer. This oxygen barrier layer generally consists of polyvinyl alcohol. In addition a third film layer is necessary in order to be able to produce the seal of the lid film.

This necessitates a relatively thick, so-called multi-layer compound film consisting of several components which preclude recycling in the sense of reuse of unalloyed materials.

A tray of this type is described e.g. in EP 0169799. Moreover there is disclosed in it a method wherein a multiplicity of individual, separate trays are introduced into a loading station and a sealing station. The trays are successively lined with a thin plastic layer before being loaded with foods and supplied to a sealing station. In the sealing station, a cover film is heat-bonded onto the trays loaded with foods. The result is a tray essentially having mechanical wood pulp or foamed plastics for a carrier material. The advantage of these packaging systems with the like trays resides in the fact that the packaging device may be given a clear-cut structure, with a modular composition of the device also being possible.

In comparison, attempts have been made to reduce the plastics content in the like food packages, which must be comparatively high in order to obtain the necessary remaining wall thicknesses in the rounded bottom portions, by employing coated paperboard. Herein it was, however, found that it is difficult to process paperboard with coated plastics materials in devices employing largely known, or already existing, modules. In addition, the maximum molding depths are limited

to 25 to 30 mm in such containers pressure-molded of coated paperboard.

Even though such containers produced in the cold molding technique are equipped to be largely oxygen-tight due to a barrier layer coating, wrinkles will form as a result of the cold molding technique due to the resulting displacement of material. These wrinkles reach as far as into the flange region of the containers, making secure and uninterrupted, but particularly oxygen-tight sealing with the cover film impossible. In order to produce for example container depths of more than 30 mm molding depth, receptacles of coated paperboard are used which are formed of cutouts. These receptacles of coated paperboard produced on a separate installation are erected, folded and bonded and supplied to the packaging system as containers.

It is, however, not successful to obtain truly gas- and oxygen-tight connections of such containers produced of coated cutouts at the cut or bonded portions thereof. Such problems particularly occur with containers presenting a peripheral flange. By the priorly known coating of paperboard cutouts merely a certain resistance against humidity is obtained, while humidity may nevertheless not be screened off entirely at the open cut edges.

There is, however, a need to furnish a food package in accordance with the preamble of claim 1, which may be produced on a conventional horizontal forming, loading and sealing plant at low expense for modification, wherein the plastics content is reduced to a minimum, however at the same time stability of the receptacle and oxygen tightness may be maintained on a particularly high level.

It is another need to further develop a method for oxygen-tight packaging of food products by employing a food package of the above specified type in such a way that packaging plants of a conventional modular construction may be operated at a higher number of work cycles and even more economically. Finally it is another object of the invention to find a device for carrying out the above mentioned method,

which is characterised by particularly low susceptance of packaging plant trouble even at a maximum number of work cycles.

In order to satisfy these requirements, there is proposed in the older patent application P 196 54 230, the contents of which are here specifically referred to, a food package as well as a method for producing it, and a device for implementing the method with a suitable semi-finished product, or tray.

The food package proposed there comprises as a supporting base a paperboard cutout lined with a thin compound plastic film, which is capable of being erected automatically and the internal region of which is bonded at the cut edges. The paperboard cutout moreover comprises a peripheral flange with single peripheral flange segments to which the lid film is then secured. In addition, the peripheral flange in accordance with the invention is given an external shape such that the peripheral flange segments abut against each other in the sealing position. To this end, the individual peripheral flange segments comprise predetermined cutting lines whereby the angular position of the peripheral flange may then be determined. Owing to the use of pre-fabricated paperboard cutouts there results the advantage that during erecting the paperboard cutouts a thickness reduction of the material will not occur in contrast with the known tray. Hereby the drawbacks incurred by thickness reduction of the material are overcome by the food package of the invention. Due to the fact that the peripheral flange segments abut against each other in the sealing position, there results an unbroken peripheral flange surface which is then employed for secure sealing of the paperboard cutout.

In the like gas- or oxygen-tight packages, particular care must, however, be taken that the tightness produced by way of the seal flanges will be ensured over a prolonged period of time. Otherwise, the specifications in terms of food processing technology cannot be satisfied. In the previously proposed package, the quality of the seal is determined by the accuracy of the cutouts. In other words, the chance of ambient air by and by penetrating into the package via capillaries in

the seal flange can be prevented only through extremely high accuracy in production of the erected trays and in positioning inside the lining and sealing station. Hereby the operating speed may be lowered unduly.

The invention is therefore based on the object of furnishing a food package of the above described type, which is characterised by the above described advantages and additionally in that it may be produced more quickly and reliably with lasting gas and oxygen tightness. It is another object to provide a method for producing such a food package which may be carried out in accordance with a simple process. Finally it is an object to furnish a device for implementing the production method, which has a simple structure and offers the particularly advantageous possibility of integrating conventional packaging plants into the device to a maximum possible extent. Finally it is moreover intended to furnish a semi-finished packaging or packaging tray which is in a particularly advantageous manner suited for the packaging method of the invention, with the design being intended to have the advantage that a high number of pieces per time unit may be produced at such high precision that the quality demands of an oxygen-tight packaging are ensured even at maximum throughput of the packaging plant.

This object is attained with respect to the food package by the features of claim 1. In accordance with the invention, the packaging is equipped with a continuous collar which thus provides a continuous surface for sealing of the packaging. The continuous, i.e., uninterrupted collar presents advantages even for tack-welding of the plastic film lining the inside of the packaging inasmuch as optimum preconditions for large-surface connection between plastic film and flange are furnished. Apart from this, it results in the additional advantage that damage to the plastic film may be precluded even at elevated operating speeds of the packaging machine. The decisive advantage becomes apparent upon sealing of the packaging. Namely, the uninterrupted surface of the flange covered by the plastic film provides optimum preconditions for a maximum possible seal connection of the lid film. It has been found that in this way the operating speeds of the packaging machine may be raised considerably without running the risk of capillary-type radial

channels deducting from long-term tightness being formed between lid film and lining film.

The design of the food package according to the invention does require a somewhat more complex structure of the package cutout. It was, however, found that the continuous peripheral flange may in a particularly advantageous manner be utilised for stabilisation of the packaging trays even where the connection between the tray components is executed in points or regions only and not full-surface.

A particularly advantageous development results from the development of claim 2. This design permits weight savings in the range of the tray part, having a positive effect on DSD expenditures.

Basically it is possible to design the attached uninterrupted collar as a closed ring. By the development of claim 3, however, the particular advantage of reduced waste production is attained. In other words, paperboard material may sensibly and effectively be utilised for stabilisation of the side walls of the tray part.

If the tabs of the flange are fastened, preferably bonded, to the side walls of the tray part, there results the particular advantage that the entire outer side of the side walls may be used for printing, i.e., as a information and publicity surface.

The packaging of the invention is particularly suited for a semi-finished product of paperboard.

If, according to claim 6, the compound plastic film comprises an oxygen barrier layer, preferably of polyvinyl alcohol, a seal layer, preferably of peelable polyethylene, as well as an adhesive layer, preferably of modified polyethylene, in particular a copolymer of ethylene with 6% methacrylic acid partially (50%) neutralised with Na or zinc ions (Surlyn A), a flexible compound is used whose oxygen permeability may be set in advance and will not change even in the embedded state. Consequently a clearly thinner PVA layer embedded in

a flexible compound may be used. Peelability of the plastic film results in excellent environmental compatibility. The plastic film may - as was found surprisingly - be kept extremely thin and yet stabilise the tray, even one consisting of simple paperboard, such that even relatively deep packages may be produced with sufficient high stability.

If the food package of the invention according to claim 9 is preferably equipped with a paperboard cutout consisting of recyclable or preferably two-layered paperboard, then a food package is obtained which is suited for carrying an imprint with a particularly strong publicity appeal on the outer layer of the paperboard cutout. Thus in particular a possibility of optically accentuating the food package according to the invention is being furnished.

The design in accordance with claim 10 has the particular advantage of the surface structure of the trays being adapted to the specific requirements. For lining of the tray it is advantageous if the plastic film heated during forming within a short period of time enters into an intimate connection with the surface of the tray part. For the outer side of the tray part, in contrast, it is essential to furnish an appealing appearance and good preconditions for the printing which will have to be carried out as a rule. It was found that the second, i.e. inner-side layer may readily consist of recycled paperboard, whereby costs may be saved and particular advantages with respect to environmental compatibility are attained.

Due to the selection of lined paperboard cutouts in accordance with the invention, a container is provided which is oxygen-tight upon entry into the evacuating and sealing station with the exception of one side, i.e. the top. As moreover the plastic-lined paperboard cutout has particularly high dimensional stability also in the range of the peripheral flanges having a particular design in accordance with the invention, this peripheral flange may securely be accommodated between the gaskets of the closed sealing tool, so that according to the invention only the inner cavity of the shaped substrate tray needs to be evacuated. Power consumption of the packaging plant for the purpose of performing

evacuation is reduced, whereby the number of work cycles of the packaging plant may be raised considerably.

It was found that owing to the peripheral flanges designed in accordance with the invention, an uncontrolled breakage cannot take place even while the trays are being loaded with food products. Operational reliability of the device may moreover additionally be raised in that the peripheral flanges positioned between the substrate tray inner cavities and having the form of sealing ridges are supported from below by means of sliding and guide rails oriented in parallel with the direction of transport. Moreover advantageous is the development where the containers are supported from below in the loading path by means of a supporting belt running in synchronicity with the transport means.

Owing to the fact that the erected paperboard cutouts of the invention in accordance with claim 15 are arranged in line in the forming station, it becomes possible to form a broadened sealing surface on the peripheral flanges between adjacent paperboard cutouts. As a result, sealing is reliably obtained. As a further result, several paperboard cutouts may be produced simultaneously, and through the broadened sealing area owing to adjacently arranged peripheral flanges, sealing is facilitated.

These developments in particular bring about advantages of far-reaching simplification of a packaging plant, as in this method a separate deep-drawing die station or particular pre-heating systems are not required any more. Nevertheless the path of passage required for these may, in accordance with the invention, be utilised for accommodating the loading station, and thus a space-saving embodiment of such a packaging plant may be created.

Either the plant may altogether become considerably shorter, or the loading path - where necessary - may clearly be made better use of, whereby the loading process will be clearly facilitated in some cases.

By the food package according to the invention the content of non-recyclable plastics may be reduced to a minimum, with the additional advantage of non-problematic decaying resulting from the selection of material for the paperboard cutouts in accordance with the invention.

Finally power consumption of the packaging plant particularly in the range of the forming station is reduced considerably as the time required for heating through a customary rigid film of approx. 500 to 1000 μm (PVC, polystyrene or polyester) may clearly be reduced. The required inherent stability of the containers is achieved in accordance with the invention by the use of the described paperboard cutout, in particular if the lid film is secured to the plastic film lining the paperboard cutout.

The food package of the invention is provided with an increased dimensional stability in comparison with food packages equally employing paperboard cutouts, and is highly resistant against torsional deformation.

One advantageous development of the production method results from the development of claim 16. Due to tack-welding the plastic film to the peripheral flanges of the trays, the latter may reliably and particularly in synchronicity be transferred into the packaging plant. This results in the additional advantage that the module of the packaging plant containing the loading plant may be preserved largely without modifications while an upstream module for feeding the trays may be positioned in particularly space-saving arrangement, i.e., overlapping by the advancing distance of one work cycle inside the plant.

The development of the method according to claim 17 results not only in an extremely high throughput rate but in particular has the advantage, in combination with the design of the tray part in accordance with the invention, of permitting extremely efficient use of the suction pressure in order to draw the lining film into the cavity of the tray part within a minimum period of time. Namely, the uninterrupted collar forming the flange permits a design of the tray part cutout in such a way

that the side walls will be separated by a slot due to the erected condition of the tray part.

Advantageous developments of the device for carrying out the method are the subject matters of appended claims 19 to 25. The tray forming part of the food package according to the invention is the subject matter of claims 23 to 29. The tray may be given just about any configuration, wherein the particular advantages may be obtained if the tray part exceeds a certain minimum depth. Preferably the bottom has a polygonal shape.

Thanks to the method of producing the trays according to claim 30 it is possible to join the parts of the trays together in minimum time and with maximum possible accuracy, thus achieving the advantage that tray production remains independent of the operating speed of the packaging plant. The trays are in a preferred manner supplied from a magazine for paperboard trays in a nested condition and from there individually supplied onto a transport belt of the transfer module of the packaging machine.

Further advantageous embodiments are the subject matters of the remaining appended claims. Hereinbelow an embodiment of the invention shall be explained in more detail by making reference to schematic drawings, wherein:

Fig. 1 is a schematic lateral view of a first embodiment of the packaging plant of the invention;

Fig. 2 is an exploded representation of a first embodiment of a paperboard tray for use in manufacture of a packaging according to the invention;

Fig. 3 is a top view of a paperboard cutout for the collar of the packaging according to Fig. 2;

Fig. 4 is a top view of the cutout according to Fig. 3, with tabs folded ready for assembly;

Fig. 5 is a top view of the associated paperboard cutout for the tray part;

Fig. 6 is a top view of the cutout according to Fig. 5 in the erected form;

Fig. 7 is a perspective view of a row of erected paperboard cutouts;

Fig. 8 is a lateral view in an enlarged scale of the forming station of the packaging plant;

Fig. 9 is a front view of the forming station shown in Fig. 8 with introduced paperboard cutouts in contiguously aligned arrangement and the compound plastic film supplied for lining;

Fig. 10 is a perspective view of paperboard cutouts aligned side by side and already lined with the compound plastic film, where in a sectional view represented in a somewhat enlarged scale according to Fig. 10A along the row of aligned paperboard cutouts indicated by the arrow, the thermo-bonded flange region is represented;

Fig. 11 is a front view of the evacuating and sealing station with inserted paperboard cutouts, already lined with compound plastic film and thus combined into a row;

Fig. 12 is a perspective view of the cohering paperboard cutouts with compound plastic film and sealed lid film, where in Fig. 12A the details of the paperboard cutout and of the adhering layers are represented more clearly in an enlarged scale;

Fig. 13 is a perspective view of a tray of the invention ready for use or consumption;

Fig. 14 is a perspective view of the tray of the invention with partly peeled-off lid film;

Fig. 15 is a perspective view of the tray of the invention with partly peeled-off lid film and partly peeled-out inner film;

Fig. 16 is a schematic representation of a cutout of the plant for manufacturing the paperboard trays;

Fig. 17 is an exploded representation corresponding to Fig. 2 of an alternative development of the tray; and

Fig. 18 is a view of the packaging machine similar to Fig. 1, wherein the trays according to Fig. 17 are processed.

Fig. 1 shows a lateral view of the packaging plant essentially consisting of five stations, namely a tack-welding station HS for tack-welding a lining film 134 for pre-fabricated trays, a forming station (FS) in which the plastic film is formed into the trays, a loading path (BS), a sealing and evacuating station (VS), and a preferably two-stage separating plant 181, 182, which latter one may as well have a one-stage construction.

Transport of the fittingly aligned paperboard cutouts or erected trays 110 to the single stations is preferably achieved through a transport chain 148 or, when employed on a so-called "Tray-Sealer", through a specially designed transport belt having receiving spaces for the paperboard cutouts positioned side by side.

Supporting belts not shown in detail may additionally be provided underneath the transport chain 148 for reducing the load on the transport chain 148 in single sections.

The module designated by "I" of the packaging machine proper, which largely has the form of a commercially available machine and may

be modified merely in certain areas is preceded by another module II, whereby separation of the nested trays 110 accommodated in a magazine or dispenser 112 and their delivery to module I is performed.

In detail, the pre-fabricated paperboard cutouts 110 - preferably adjacent in rows of 2 to 5 trays - are with the aid of a separating device VV9 preferably operating pneumatically supplied in fixed-cycle control onto a partitioned belt 112, whereby furthermore the at least one paperboard cutout is transported into a transfer station ÜS. There, also in fixed-cycle control, the at least one tray 110 is raised in a vertical upward direction into the plane EKF of the plastic film 134 and into the range of the tack-welding station HS by means of a raising station 114 employing a dedicated transport die 113; the lining film is then tack-welded preferably at single points to the leading and/or trailing regions of the tray flanges by means of heatable dies 118. In a Tray-Sealer-System, the paperboard cutouts are inserted into corresponding reception spaces of the transport chain 148.

By this configuration it is possible to arrange module II at very low space demand, and to do away with the overlapping region ÜB in the direction of transport.

Starting out from this tack-welding station, in which the abuttingly aligned pre-fabricated trays contact the plastic film and enter into the forming station FS, the actual process of shaping or lining the trays 110 by means of the plastic film, preferably the compound plastic film 134, begins. In the forming station, lining of the inner surface of the contiguously aligned paperboard trays 110 with an oxygen-barrier compound plastic film 134 is performed.

The compound plastic film 134 is drawn from an endless reel 133 mounted above the introduction path of the packaging plant on a carrier arm via deflection rollers over the trays 110 aligned in the receiving molds and substantially in parallel with the transport chain 148.

When a Tray-Sealer is used, the transport chain 148 in fixed-cycle control feeds the aligned trays 110 resting in the receiving spaces of the transport chain underneath a forming station FS; the operating principle of this forming station for lining the inner surfaces of the trays 110 with the compound plastic film 134 corresponds to the one of the Iso-Pack-System of MULTIVAC as used in a forming, loading and sealing plant.

Subsequently, the trays 110 are conveyed by means of the transport chain 148 into the range of a loading path BS which is also designed such as to permit in-line loading in fixed cycles.

In order to reduce the load on the transport chain 148, the trays 110 now cohering by the compound plastic film 134 may be supported by a supporting belt operating in synchronicity with the transport chain.

From the loading path BS the loaded trays pass into an evacuating and sealing station VS, wherein concurrently a lid film 120 fed from an endless reel 122 via a system of deflection rollers is supplied into the evacuating and sealing station VS substantially in parallel with the transport path. The function of the evacuating and sealing station VS corresponds to that of conventional systems, e.g. by Multivac, and is described in detail in Fig. 12.

Following sealing of the loaded packaging containers, these are in turn supplied to the separating stations 181, 182 by means of the transport chain, wherein it is again possible to support the aligned, cohering trays 110 by means of a synchronously operating transport belt 150.

As can also be seen in Fig. 1, the transport path of the transport chain 148 and of the supporting belt 150 extends from the dispenser to immediately downstream of the two-stage separating station 181, 182, so that the entire plant operates in synchronicity.

It is a particularity of the packaging device that on the one hand, a specially designed tray 110 is employed, and on the other hand, this

tray 110 is supplied to the packaging plant in a particular manner, namely in the form of a specially designed semi-finished product.

Contrary to conventional types of such packaging plants, a tray 10 already pre-formed and dimensionally stabilised e.g. by bonding, which comprises a top-side peripheral flange 52, is supplied by the dispenser 112. The semi-finished products or trays 10 supplied to the packaging device - as is shown in the exploded view of Fig. 2 - in accordance with the invention comprise specially designed peripheral flanges 52 constituted by a continuous collar placed onto a tray part 40.

Fig. 2 shows the two components of the trays 10 in the pre-fabricated condition immediately prior to assembly and connection, preferably bonding, of the parts. Figs. 3 to 5 show detailed top views of the parts.

Both parts are designed as paperboard cutouts, with preferably a two- or multi-layer paperboard being used, so that the outsides of the trays may have properties different from those of the insides. The cutout for the collar constituting the flange 52 - as shown in Fig. 3 - presents cuts for forming trapezoidal tabs 51 which are connected to the flange through predetermined folds.

The tray part 40 has a cut shape in accordance with Figs. 5 and 6. To a bottom part 41 there are connected through folds 42 the side wall portions 43 contacting each other in the erected condition (Fig. 6 and Fig. 2).

Inasmuch as the tabs 51 having an angular configuration are connected, preferably bonded, while placed on the tray part 40 with the side walls 43, the latter are stabilised by the flange 52, resulting in high torsional rigidity of the trays at low material expenditure.

The bonding connection is preferably carried out in the form of dots or lines, as is indicated by the hatched regions 47 in Fig. 2.

The tabs 51 are secured to the inner side of the side walls 43, so that the outside of the side walls remains continuous, which is favorable for printing.

The height H43 of the walls 43 is greater than the height H51 of the tabs 51, i.e., the tabs only encompass a fraction of the side walls, resulting in savings in term of weight and thus DSD expenditure.

Fig. 7 is a perspective representation of erected and aligned paperboard cutouts 10 also revealing an optionally provided gripping recess GM which may be provided on an edge segment of the flanges 52.

The lateral view of Fig. 8 shows the manner in which the tool parts 116 and 118 in the forming station FS cooperate with the contiguously aligned trays and by means of heating means 172 line the inner surfaces and surfaces, respectively, of contiguously aligned trays 10 with the compound plastic film 134.

The tool of the forming station FS, which operates according to the so-called Skin method, is comprised of a lower mold 116 and an upper mold 118 which are synchronously moved apart and approached in accordance with the arrow shown in Fig. 8. Herein the lower mold 116 preferably presents a profile for positive reception of the paperboard cutouts 10, so that the peripheral flanges 52 of the paperboard cutouts 10 are supported in a sealed manner. The upper mold 118 is moreover designed such that heating means 172 may be accommodated. 173 and 173A represent recesses in the upper and lower parts 116,118, which are designed in accordance with the gripping recesses GM.

Fig. 4 shows the front view of the forming station FS. It can be seen that the lower mold 116 presents ridge-type inserts 166 whose shape is adapted to a cross-section of the aligned and erected trays 10. The closely contiguous peripheral flanges of adjacent trays 10 fittingly rest on these ridge-shaped inserts, so that in the approached state of tool parts 116 and 118 the individual trays are moreover positively

supported by the provided mold inserts 158, the surface contours of which fittingly correspond to the shape of the single trays. The operation of the forming station FS, in particular the Skin method, shall be briefly described in the following:

When a row of erected paperboard cutouts, which are aligned in close contact by their peripheral flanges and thus form a saddle-shaped support, is introduced into the forming station FS by means of the tack-welded plastic film 134 (tack-welding points), then the previously lowered lower tool part 116 of the forming station FS moves upwards in the direction of the arrow. While the lower tool part 116 is approached towards the upper tool part 118, a nearly perfect vacuum is applied in the upper tool part 118. The compound plastic film 134 overlying the aligned, closely contiguous paperboard cutouts 10 is thereby brought into full-surface contact with the heating plate 172 and heated throughout.

Following termination of the specified heating period, the upper tool part 118 is aerated at concurrent evacuation of the lower tool part 116. This change results in a differential pressure of approx. 1 bar bringing about full-surface thermo-bonding between the compound plastic film and the tray insides (cf. phantom line 134A). As linear openings remain between the side wall portions 43 owing to the configuration of the tray part 40, sucking-in of the film may even be supported.

At the same time, the continuous peripheral flanges 52 are heat-bonded over their entire surface.

As the inner surfaces of the closely contiguously aligned paperboard cutouts are now lined with the compound plastic films, the forming station FS is opened in synchronicity, whereby the trays now coherently connected by the compound plastic film are released and conveyed for loading by the transport chain 148.

Fig. 10 shows the row of paperboard cutouts formed by the closely contiguous trays 10 lined on the inside and cohering by the compound

plastic film 134 as it is leaving the forming station FS. It can also be seen that the compound plastic film 134 also covers the gripping recess GM in the peripheral flange.

In Fig. 10A (sectional view along the peripheral flange 52 of a tray 10 with an overlying compound film 134), the single layers constituting the compound film are represented. The compound plastic film 134 comprises an oxygen barrier layer 136, preferably of polyvinyl alcohol (EVOH) and a seal layer 138, preferably of peelable polyethylene, as well as an adhesive layer 137, preferably of modified polyethylene. It was found that the internal lining of the carrier material forming the food package may be executed to be extremely thin. The film thickness in the region of the remaining wall thicknesses in the rounded bottom portions preferably lies between 25 and 30 μm.

Through selection of a suitable surface structure of the paperboard on the inside of the trays 10, interlocking of the film 134 with the paperboard may be optimised further.

The compound plastic film 134 may in addition be constructed and adjusted in its properties such that it may be peeled from the paperboard substrate after use of the package, whereby unalloyed components are provided for disposal or recycling. In accordance with the invention, the gripping recess GM serves the same purpose.

After leaving the forming station FS, the cohering trays 10 pass through the loading station along the loading path BS while being loaded with the food products to be packaged. Transport of the cohering trays 10 by the common plant is equally performed in fixed-cycle control. From the loading path BS, the loaded trays 10 enter into the evacuating and sealing station VS where they are fittingly received by the lower part 16 thanks to corresponding form inserts (see Fig. 11). Such an evacuating and sealing station having the conventional construction consists of a lower part 216 and an upper part 218 which are moved apart and approached in fixed-cycle control. The lower mold 216 preferably has a profile for completely receiving the trays 10 designed in

accordance with the invention in such a way that the peripheral flanges of the trays may be supported sealingly. The upper part is designed such that it may accommodate the heating plate 274 presenting a line pattern, movable in a vertical direction.

The line pattern is designed such as to define planar regions at which sealing of the paperboard cutout peripheral flange with the lid film 120 is to be performed.

Fig. 12 illustrates the function of such an evacuating or sealing tool used in accordance with the invention. For this process step, previously known and well tried conventional systems may equally be employed with slight modifications. Fig. 12 shows the lower mold 216 with the ridge-type inserts 266, the shape of which is adapted to a cross-section of the saddle strip forming between two adjacent peripheral flanges of the trays 10, so that in the approached state of the tool parts 116 and 118 the cohering trays 10 are positively supported by the provided mold insert 258, whose surface contour corresponds to the shape of the trays placed thereon. Reference number 270 designates gaskets against which the peripheral flanges, or the saddle ridges, of the cohering trays 10 rest in the approached condition of the tool 216 and 218, so that evacuation of the single paperboard cutouts already containing the food products in this state may be performed.

274 designates heating means accommodated in the upper tool part 218 in accordance with a pattern aligned with the peripheral ridges, with sealing of the lid film 120 with the respective flanges of the individual containers being carried out in the approached condition of the tool parts 216 and 218, such that an annular continuous sealing surface is created.

Owing to the particular design of the continuous flanges 52, sealing is effected free of capillary channels which might allow gas exchange with the environment.

In this place it should be noted that it is possible to employ a commercially available evacuating station wherein it is possible to also carry out gas charging following evacuation, e.g. with the customary gas mixture N_2/CO_2 mostly in the ratio of 70:30. The heating plate 274 located in the upper part of the tool 218 is preferably formed to comprise raised sealing ridges, with the lid film being sealed with the seal coating of the annular peripheral flange and the resulting saddle ridges of the cohering trays through the influence of heat and pressure.

Fig. 12 shows the trays 10 which are loaded with food products, sealed and cohered, after leaving the evacuating and sealing station.

As can be seen from the chosen hatching, the entire compound plastic film 134 is heat bonded to the lid film 120 at the provided sealing surfaces. Merely in the range of the gripping recess shown under GM and provided in the rear flange region (when viewed in the direction of production), sealing of the compound plastic film 134 with the lid film 120 is prevented by a special design of the sealing tool. This makes it possible, by making use of the punched portion of the gripping recess GM provided in the rear flange and of the lid film 120 not sealed with the compound plastic film 134 in this location, to later on peel off the film lid or peel out the compound plastic film from the tray 10.

Having left the evacuating and sealing station VS, the loaded paperboard cutouts cohering by the lid film and the compound plastic film 134 are supplied to a preferably two-stage separating plant 181, 182.

It is equally possible to employ combination punching and separation of the individual food packages. In combination punching the second separating step is thus omitted. After leaving the separating station, the single trays are present as shown in Fig. 13.

By the above described food package it is made possible, depending on the desired design of shape, to save an average of about

20 g of non-recyclable plastics per food package, i.e., approx. 70% of the quantity incurred in conventional packages of this type.

The operational width of the device is, of course, not limited. Nevertheless it has been found that the widths should amount to at least 420 mm in order to maintain a particularly high level of cost-effectiveness of the device.

The lid film 120 is preferably also produced of a compound plastic film 134 containing an oxygen barrier layer which is covered by a peelable plastic layer preferably of modified polyethylene on the side facing the paperboard cutout. This layer then forms the sealing seams with the compound plastic film 134 over seal ridges of the peripheral flanges.

The film layer facing the heating or sealing member 272 preferably is a type of film having a particularly high melting point or a thermal barrier layer preferably containing polyethylene and overlying the oxygen barrier layer, to provide for sufficient dimensional and planar stability upon sealing with the lower mold part in the sealing process. Inasmuch as the seal layers of the paperboard cutout surface as well as of the lid film 120 are preferably adapted to each other such as to be "peelable", in sealing these two seal layers a solid combination is created which may be peeled by hand largely without destroying the paperboard cutout sheet 34 (see Fig. 14).

It will be appreciated that embodiments different from the above described one are possible without departing from the gist of the invention. Thus it is a matter of fact that the number of aligned fed trays may be varied according to desire per row or work cycle.

It is equally conceivable to degerminate or sterilise the rows of plastic cutouts by means of a particular device after they have left the forming station FS. Advantageously this will be a so-called "hydrogen peroxide/hydrogenated water shower".

Due to the employed method of the invention in the oxygen-tight compound plastic film as well as in the oxygen-tight lid film 120, a compound combination of films of the polyolefin group may be employed. This compound combination can be recycled as a monofilm. It was found that this regranulate may be used as a filler material in the field of high-density PE film production.

Due to the internal lining performed with the compound plastic film, stability of the tray is improved quite considerably, particularly owing to the peripheral flanges designed according to the invention. Following its consolidation the compound plastic film 134 considerably loses flexibility and additionally reinforces the tray over the peripheral flanges.

In subsequent sealing with the lid film over the annular flanges, the paperboard cutout is provided with additional bonding strength and torsional rigidity.

Extremely secure sealing with the paperboard cutouts lined with barrier layer compound film by means of the barrier layer lid film is created in accordance with the invention in that the closely contiguous annular flanges form so-called saddle ridges with a sealing surface which is increased to the two-fold of conventional peripheral flanges.

As the entire available sealing surface thermo-bonded with the seal side of the barrier layer plastic compound film 134 is available as a sealing surface with the lid film 120, a sufficiently wide area for the formation of a secure sealing seam is regularly ensured by the separation which is performed only after sealing.

In individually supplied trays not having this particular formation of the peripheral flange in accordance with the invention, a homogeneously wide and thus sufficiently secure sealing surface cannot be obtained owing to tolerances upon fixation of the paperboard cutouts in the method process or owing to variations in paperboard cutout design resulting from production conditions. Separation of the oxygen-tight film inner component from the inherently stabilising paperboard cutout is

another essential point of the invention (cf. Fig. 14). The compound plastic film lining the inside of the paperboard cutout is combined with the fibers of the inner walls and of the bottom surface of the paperboard cutout by thermo-bonding.

By known methods, for example the Multivac Skin System, wherein the compound plastic film, which is heated and thus rendered ductile, with the specially produced lamination, preferably containing a Surlyn mixture by Dupont or a mixture (PE type) having a particularly high (preferably more than 20%) ethylene vinyl acetate content, the compound film, having been rendered ductile, is pressed against the tray's inner surfaces by the corresponding pressure difference and may penetrate into the fibers of this inner surface.

Following evacuation or application of gas, respectively, the lid film 120 is in the sealing station firmly combined with the bottom part of the packages over the annular peripheral flanges and the saddle ridges of the aligned, cohering paperboard cutouts which are coated with a seal layer as set forth in the description of the method.

The provided semi-oval recess (GM) of the rear flange in the direction of transport, and the corresponding design of the sealing tool in this range creates the possibility, by means of a so-called gripping lug which is formed by lid film not sealed with lining sheet in this place, to peel the entire compound at the provided gripping recess GM from the resulting pure paperboard cutout which may then be composted as an unalloyed material.

Another range of application of the food package is to peel the lid film off the sealing ridges in order to open the packages and enable easy removal of its contents without a tool. This may be achieved by a particular design of the sealing tool in the sealing station not incurring any major modification work.

In this case the consumer will remove the lid film from the sealing surfaces until he can easily take out the contents (see Fig. 15). The

compound plastic film and the lid film not entirely peeled off are then jointly removed via the gripping lug from the actual paperboard cutout at the gripping recess provided for this purpose. Hereby separation into unalloyed materials has been performed, and the single materials may thus be supplied to their further recycling.

Fig. 16 shows a schematic view of a tool for manufacturing the trays 10. In a bottom mold 316, the paperboard cutout 40 is erected and fittingly stabilised by means of air evacuation means 319. The upper mold 318 carrying the erected collar with flange 62 is arranged in alignment above the bottom mold.

Approaching the molds 316, 318 is carried out after applying a cold or hot-melt adhesive on the overlapping surfaces of side walls and/or tabs. If hot-melt adhesive is used, the setting time may be controlled more precisely to thereby further raise the cycle times during production. In Fig. 16 the areas for application of adhesive are shown with varying shapes, which is to indicate that there is a variety of alternatives in design depending on the strain profile of a tray.

It is, of course, possible to carry out modifications without departing from the inventive concept. Fig. 17 shows a somewhat modified configuration of the trays. The collar 452 is formed without tabs and accurately placed over the angularly extending flange segments 444 of the side walls 443 of the tray parts 440 and fixedly connected, preferably bonded, with these. "x" designates those areas wherein adjacent wall segments 443 are connected to each other by overlapping tabs 443 A.

For this tray, a modification of the packaging plant in accordance with Fig. 18 may be meaningful. Erected or pre-fabricated trays 510 are taken from a magazine 512 to form rows, and transferred to a fixed-cycle conveyor belt 511. The trays 510 are then transported underneath a plug device including a plug 517 wherein the flange formed by the segments 444 is folded prior to setting the collars 452 in position in the bonding station KS, namely in such a way that a surface as planar as

possible for positioning the collars and optimum alignment of the sections 444 is created. The plug 517 is designed such that the peripheral flange 552 is folded into a sealing position permitted by the respective predetermined cut at the ends of the peripheral flange segments 444, wherein it has a corresponding inclination. The bonding station is followed by the transfer station ÜS (see Fig. 1).

If a method according to the known Tray-Sealer is employed, the transport chain 148 transports the trays 10 arranged in closely adjacent alignment into the forming station FS in fixed-cycle control. The forming station FS may also be designed e.g. like a station operating in accordance with the Skin-System of a forming, loading and sealing plant in accordance with Multivac CD6000.

The invention thus furnishes a food package having the form of a dimensionally stable paperboard cutout with a top side peripheral flange which, according to the invention, is continuous and placed on the tray part. The seal surface along the flange in this way is imparted a particularly high quality ensuring permanent tightness.

The substrate tray consists of paperboard and carries on the inside in the range of the flaps formed into the peripheral flanges an oxygen barrier plastic film suited for sealing with the lid film.

There is moreover described a method, a device for producing an oxygen-tight food package, wherein pre-formed and dimensionally stable trays are supplied by a dispenser system or, in the case of insertion through a so-called Tray-Sealer, i.e. direct insertion from the dispenser into the receiving molds of the transport chain of a Tray-Sealer. In a forming station these trays are lined with a compound plastic film preferably containing an oxygen barrier layer.